

Claims:

1. – 65 (cancelled)

66. (original) A wavelength selective optical device, comprising  
a silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;  
and  
a filter coupled to the superlattice.

67. (original) An optical switch, comprising:  
a silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;  
and  
an optical waveguide.

68. (original) An optical device, comprising:  
a silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;  
a silicon containing layer positioned on a surface of the superlattice; and  
at least one transistor positioned on a surface of the silicon containing layer.

69. (original) A nonlinear optical device comprising:  
a plurality of adjacent silicon based superlattice structures including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;  
wherein each adjacent superlattice structure is grown in an alternating fashion to create a periodic variation in a refractive index

70. (cancelled)

71. (original) An optical receiver, comprising:  
at least one p-doped layer;  
at least one n- doped layer;  
a silicon based superlattice positioned between the at least one p-doped layer and the at least one n-doped layer; the silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at

least one rare earth ion; and

at least two electrodes coupled to the at least one p-doped layer and the at least one n-doped layer of p-doped layer.

72. (original) The receiver of claim 71, wherein at least one p-doped layer and the at least one n-doped layer are made substantially of silicon.

73. (original) A semiconductor edge-emitting laser,  
first and second reflectors defining a resonator;  
a silicon based superlattice positioned between the first and second reflectors, the silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;  
a confinement region that includes at least two electrodes.

74. (original) The laser of claim 73, further comprising:  
cleaved or etched facets.

75. (original) The laser of claim 73, wherein the confinement region is positioned in a direction substantially parallel to an optical output direction of the laser.

76. (original) A laser assembly, comprising:  
first and second reflectors defining a laser resonator;  
a silicon based superlattice positioned between the first and second reflectors, the silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion; wherein the repeating units are periodic, and a period and composition of the repeating units is selected to produce a desired output wavelength.

77. (original) The assembly of claim 76, wherein the first reflector is a distributed Bragg reflector.

78. (original) The assembly of claim 76, further comprising:  
an optical amplifier.

79. (original) A vertical cavity surface emitting semiconductor laser, comprising:  
first and second reflectors defining a resonator;  
a silicon based superlattice positioned between the first and second reflectors and

confined to a substantially circular region whose diameter matches a single mode diameter of the laser, the silicon based superlattice including a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion and the repeating units are periodic, with a period and composition of the repeating units selected to produce a desired output wavelength.

80. (original) The laser of claim 79, wherein the first reflector is a distributed Bragg reflector.

81. - 104. (cancelled)

105. (original) A photonic device, comprising:  
a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein at least a portion of the superlattice is made of substantially Group III-V or II-VI materials

106. (original) A structure for efficient excitation or de-excitation mechanisms of crystal field engineered rare-earth silicon-based superlattice, comprising:  
a silicon semiconductor based superlattice that includes a plurality of layers that form a plurality of repeating units, at least one of the layers being an optically active layer with at least one species of rare earth ion;  
a first layer of semiconductor materials, and  
a second layer of semiconductor materials, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a wider bandgap than the superlattice.

107. (cancelled)

108. (original) A silicon semiconductor based superlattice, comprising:  
a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein the superlattice forms a portion of a heterojunction bipolar transistor.

109. (original) A silicon semiconductor based superlattice, comprising:  
a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion,

wherein at least a portion of the plurality of layers are interleaved with a plurality of quantum wells.

110. (original) An electrically pumped amplifier, comprising:  
a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein the layers are ultra-thin epitaxial layers.

111. (cancelled)

112. (original) A bipolar transistor, comprising:  
a collector including a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein the superlattice has a miniband injector as an emitter region.

113. (cancelled)